
Symposium Abstract

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COSMOLOGY

Thinking in Four Dimensions to Understand Einstein Relativity

Learn how thinking in four-dimensional space simplifies the complex, and sometimes mystifying, Einstein Relativity Theory. How can the moving twin in Einstein's Twin Paradox age at a slower rate if the moving twin observes a normal aging process? Why can't the moving twin see the Earth as the moving object and on the return trip meet a younger Earth twin? You will learn what happens to the twins and be able to conceptualize the answers in this class. Topics include the history of three-dimensional space, the history of four-dimensional space, and the space-time continuum created by Hermann Minkowski that Albert Einstein used to explain his Theory of Special Relativity. (Two sessions)

Saturday, March ?, 2001

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The lecture introduces thinking in four dimensions as a way to provide a clear understanding of motion through space using only introductory physics and its mathematics.

- **History** The history of ideas about space is our concept of space.
- **Thinking in Four Dimensions** Thinking in three dimensions makes understanding a four-dimensional concept of space difficult. It is very hard to stop thinking in the familiar three-dimensional space around us.
- **Time-space vs. Space-time** Moving through time-space at various velocities makes more sense than the concept of a space-time continuum.
- **Time in Four Dimensions** Time in four-dimensional space is best considered as synchronous and isochronic.
- **Motion** All objects move with the speed of light at all times.
- **Viewing Four-Dimensional Space** Four unique three-dimensional projections from space provide a good, however limited, view of four-dimensional "superspace."
- **Time Dilation** Einstein's time dilation is a contraction of time-space.

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The lecture continues with important new ways to understand ideas from astronomy, Einstein Relativity Theory, and physics.

- **Traveling Backwards in Time** Time-space and its equations show that reverse time travel could exist.
- **Velocity of Light** The velocity of light is not constant, but can be viewed as a rotating vector.
- **Mass Dilation** The Einstein concept of mass dilation can be seen as density dilation when looking at three-dimensional projections from four dimensional space.
- **$E = mc^2$** This famous formula is easily derived with physics that states energy is the product of momentum and velocity.
- **Acceleration** Time-space is a concept that allows for accelerated motion, including the acceleration due to gravity.
- **The Expanding Universe** The universe only expands in three-dimensional space. In four-dimensional space it is a steady state universe. Einstein was not wrong.
- **Nature of Light** A photon is never at rest, nor is any matter—for that matter.